

## UNIVERSAL BRACKET SYSTEM

### CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based upon and claims priority of United States Provisional Patent Application Serial No. 60/414,509, filed September 27, 2002.

### STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

5 Not applicable.

### REFERENCE TO A MICROFICHE APPENDIX

Not applicable.

## BACKGROUND OF THE INVENTION

### Field of the Invention

10 The field of the invention relates to brackets for supporting various articles of manufacture and, more particularly, brackets having a substantially cantilevered structure which may be releasably mounted to fixedly secured racks, ladders or the like.

### Background Art

15 Throughout modern history, various types of mechanical "support" assemblies have been developed for a wide variety of applications. For example, numerous structures have been designed for purposes of supporting bookshelves and other shelving configurations. Other types of support systems are utilized in product display infrastructure, such as frames and the like which may be found in supermarkets, department stores and other retail establishments.

20 Various types of support systems are also employed in other capacities associated with residential and industrial establishments. For example, various types of support systems have been developed for purposes of holding tools, kitchen utensils, cookware and other household and industrial establishment articles. Still further, various types of support systems are often designed for articles of clothing and the like.

For a number of years, support systems have been designed which advantageously provide for "reconfiguration" of the support structure. In this manner, articles of manufacture to be mounted on a support structure as supporting elements can be adjusted as desired. In this regard, it has been known to use, in the prior art, what is often characterized as a "universal" bracket structure, which may be coupled to a fixedly secured rack or similar structure in a manually releasable manner. The structure and appearance of such universal bracket and rack arrangements is well known. Such structures are often used for bookshelves, refrigerator shelving and the like.

An example of a prior art system employing known technology for bracket and rack system, is illustrated in FIGS. 1 and 2. More specifically, the prior art system includes a bracket 100. The bracket 100 includes an elongated section 102 terminating at a distal end 104. The distal end 104 includes a conventional and upwardly projecting lip 106 which is used to maintain the item to be supported (shelf or the like) on an upper surface 108 of the elongated section 102.

Continuing to refer to FIGS. 1 and 2, a proximal end 110 of the bracket 100 is of a configuration primarily shown in the side elevation view of FIG. 2. The proximal end 110 includes an upper portion 112 having somewhat of an arcuate finger 114. The arcuate shape of the finger 114 essentially curves back against itself so as to form an upper recess 116. The upper recess 116 is part of a slot 118 which is formed between the upper finger 114 and an intermediate portion 120 having a shape as primarily shown in FIG. 2, and forming somewhat of a partial vertical section of a trapezoid. The intermediate portion 120 includes an upper surface 122, angular surface 124 and underside 126. In a typical configuration for the bracket 100, the

elongated section 102, distal end 104 and proximal end 110 are integrally formed and constructed of various metals.

For purposes of mounting the bracket in a manually releasable manner, brackets such as the bracket 100 are typically used with fixedly secured racks, such as the rack 130 illustrated in FIG. 5. The rack 130 will be described in greater detail with respect to the bracket arrangement in accordance with the invention in subsequent paragraphs herein. For purposes of describing the prior art, it is sufficient to state that the horizontal rack 130 includes an upper row of rack slots 132, and a lower row of rack slots 134. The upper rack slots 132 are positioned so as to be directly above and aligned with the lower rack slots 134.

A sectional end view of the horizontal rack 130 is illustrated in FIG. 2, in a diagrammatic fashion. That is, the illustration of the horizontal rack 130 in FIG. 2 primarily illustrates the upper rack slots 132 and lower rack slots 134. The horizontal rack 130 can be fixedly secured to a wall or any other surface (not shown) in a conventional manner. In addition to horizontally disposed racks, such as rack 130, it is also known to use vertically disposed racks or "ladders" in various support systems. For example, vertically disposed ladders are often used for refrigerator shelving and relatively well known "do it yourself" residential bookshelving.

Turning to FIG. 2, and referring to the releasable interconnection between the bracket 100 and the horizontal rack 130, the bracket 100 is inserted into the rack 130 by first inserting the finger 114 of the upper portion 112 within an upper slot 132. After insertion, the finger 114 can be pivoted slightly in a direction whereby the distal end 104 moves upwardly. In this manner, the finger 114 can be moved further inwardly within the slot 132 so that the upper recess 116 formed by the finger 114 essentially "captures" the portion 136 of the horizontal rack 130 which exists between the upper rack slot 132 and the lower rack slot 134. As the bracket

100 is pivoted downwardly in a manner so that the distal end 104 moves downward and the bracket 100 is brought into a horizontally disposed position, the intermediate portion 120 moves into the lower rack slot 134. This "final" configuration is illustrated in FIG. 2. In this configuration, the upper surface of the recess 116 essentially rests upon an upper surface of the intermediate portion 136 of the rack 130. It is this abutment which provides the gravitational support so as to prevent vertically downward movement of the bracket 100. The capturing of the intermediate portion 136 of the rack 130 within the slot 118 essentially prohibits any substantial pivotal movement in a downward manner.

The foregoing description of the bracket 100 and the manner in which it is manually and releasably coupled to the supporting horizontal rack 130 is commonly referred to as a "hook-over" configuration. That is, the finger 114 of the upper portion 112 essentially "hooks over" the intermediate portion 136 of the rack 130, such that the intermediate portion 136 is captured within the slot 118, in a manner so that the upper surface of the recess 116 rests upon (and is supported by) the upper surface of the intermediate portion 136 of the rack 130.

One difficulty with respect to the bracket 100 configuration relates to stress distribution throughout the support components. Cantilevered loads produce certain pivotal stresses in a manner such that the stress distribution may comprise highly localized stresses. That is, the stress concentration factor may be relatively high. Such stress concentrations may readily produce cracks, fractures and complete failures.

Support and other systems employing bracket configurations are well known with respect to numerous other applications. For example, Henry et al., U.S. Patent No. 6,062,399 issued May 16, 2000 describes a merchandise display system which may be installed on a variety of merchandise display frames. The system is adapted to mount on numerous known display

frames, with particular application for gondolas. Such gondolas typically have two horizontally spaced apart mounting stanchions, with the stanchions each having a series of apertures therein.

The display system includes a universal mount with two universal brackets carried by a cross bar. The brackets are selectively moveable on and along the cross bar for alignment with the

5 stanchion apertures. When the universal brackets are appropriately aligned, the universal mount can be secured to the display frame by engaging the universal brackets with the aligned apertures. A frame assembly which may include a pegboard configuration can then be removably secured to the universal mount. Each universal bracket includes an engagement tab which is sized and shaped so as to engage an aperture defined in the stanchion. A further  
10 aperture is defined in the universal bracket and is sized and shaped so as to permit the bracket to move freely on and along the cross bar.

Chandler, Jr. et al., U.S. Patent No. 6,439,533 issued August 27, 2002 describes a universal mounting system for attaching an enclosure to a fiber optic rack. In one embodiment, the mounting system includes a pair of identical rack brackets, with each bracket having a planar  
15 rack-mounting plate and a pair of support tabs.

Chiang et al., U.S. Patent No. 5,934,639 issued August 10, 1999 describes a universal bracket adapted for attachment of casters to wire fabricated components. The bracket includes a lower bracket component hingedly connected through a plastic hinge to an upper bracket component. The upper bracket component includes a front flange having a pair of  
20 grooves, with the innermost portion of the grooves having indentations. The indentations are designed for accommodating the insertion of tabs provided at the front of the lower bracket component. The lower bracket component includes a pair of side walls, with a series of grooves or slots provided through the upper edges of the side walls. These grooves or slots are designed

for accommodating the insertion of wire components, such as components from carts, baskets, shelves or the like. When the upper bracket components are folded over about the plastic hinge, it will embrace the wires and retain the same.

Newton et al., U.S. Patent No. 4,826,120 describes a mounting bracket having a  
5 horizontal base, with a pair of laterally spaced and upwardly directed mounting arms terminating above the base in a pair of laterally outwardly formed downwardly directed elongate mounting channels. Lugs are positioned in each channel along the channel length, and cooperate with the channel so as to define a snap-lock. Oppositely directed support shoulders are formed with the base and provide spaced, co-planar support surfaces mounting opposed positioning ribs. The  
10 ribs cooperatively form a snap-lock retainer, including converging forward portions and laterally enlarged rear seating portions. Retaining flanges are formed with the base and depend into spaced overlying relation to the plane of the shoulder surfaces.

Edwards et al., U.S. Patent No. 5,636,818 issued June 10, 1997 discloses a support bracket for a shopping cart display. More specifically, a bracket assembly is disclosed  
15 having a mounting member and a U-shaped clamp configured so as to receive the handle of a shopping cart. The clamp is capable of adjustable attachment to the mounting member. The mounting member includes spaced apart ends extending from a central portion having spaced apart bores. The clamp has out-turned ends with slots positioned so as to align with the bores of the central portion of the mounting member for adjustable attachment. The brackets are also  
20 disclosed as potentially including a support member configured to engage an inner surface of the mounting member, and attached to the mounting member at its central portion and at one of its spaced apart ends.

Heroy, U.S. Patent No. 3,669,278 issued June 13, 1972 describes a display shelf divider. The divider includes wire or the like releasably attached between shelf openings by means of brackets. Each bracket includes a flat member with a depending tab having a pair of opposed, hooked edges for engaging a shelf opening singularly or together. The spacing  
5 between the hooked edges of the member tapers to less than the thickness of the shelf. In this manner, the bracket is urged against the shelf when moved in a plane parallel to the shelf.

Meska et al., U.S. Patent No. 4,566,666 issued January 28, 1986 describes a small appliance wall bracket. The bracket includes two plastic wire bracket members capable of being hand-bent to a desired shape, so as to receive any of different sized and shaped appliances. One  
10 wire member is a long wire member and has a U-shaped end loop for hanging the appliance electrical cord. The wire members are mounted in a two-part base which also forms a cover for an electrical power outlet. In a further embodiment, Meska et al. disclose the base as being circular and mounted by a screw or adhesive. In both embodiments, the bases have front and back portions defining T-shaped hollows that receive the ends bent into an elbow of the wire  
15 members.

Saffold, U.S. Patent No. 4,088,253 issued May 9, 1978 discloses a rack for carrying bicycles on cars or trucks. The rack includes a pair of retaining bars, with each bar having a relatively long upright arm. The arms terminate in a notched opening, with the opening adapted to be received between a bicycle frame and a wheel axle. Means are provided for  
20 securing the bars to an automobile or truck, with the bars laterally displaced from each other by a distance corresponding to the wheel base of the bicycle. In one embodiment, Saffold discloses each bar as comprising a long arm connected to a short arm. The short arm is adapted to restrain

the bicycle wheel on the side of the bicycle wheel opposite the side where the long arm is existent.

## SUMMARY OF THE INVENTION

In accordance with the invention, a bracket system comprises a bracket and is  
5 adapted for use with a supporting structure. The bracket includes end means adapted for being at least partially received through a first receiving aperture of the supporting structure. The bracket is then in a first coupling position relative to the supporting structure. At least one downwardly projecting slot is provided for receiving a first portion of the supporting structure, when the bracket is in a final coupling position relative to the supporting structure. The bracket and the  
10 downwardly projecting slot are sized and configured so that rotational or pivotable forces externally exerted on the bracket about the downwardly projecting slot are prevented from moving the bracket from the final coupling position to the first coupling position. Further, the bracket can be sized and configured so that movement of the bracket from the final coupling position to the first coupling position requires the bracket to be first lifted directly vertically  
15 upward relative to the supporting structure. Further, when the bracket is in the final coupling position, a cantilevered load can be placed on the bracket and result in an absence of substantial, highly localized stresses in the bracket.

The downwardly projecting slot can be located on or adjacent the end means. The first portion of the supporting structure can be a vertically directed section of the supporting  
20 structure, which also forms a lower boundary of the first receiving aperture of the supporting structure. When the bracket is in the final coupling position, the first portion of the supporting structure is supported on an upper surface of the downwardly projecting slot.



The end means can comprise an upright portion and an arcuate intermediate portion. The downwardly projecting slot can be formed on an underside of the arcuate and intermediate portion. The support structure includes a rack having the first receiving aperture formed in a lateral surface of the rack. The upright portion is extended through the first  
5 receiving aperture when the bracket is in the final coupling position. The rack also can comprise an upper rack aperture formed in an upper surface of the rack. When the bracket is in the final coupling position, an end of the upright portion at least partially extends upwardly through the upper rack aperture.

In accordance with the further aspect of the invention, the bracket can comprise  
10 the at least one downwardly projecting slot and a second downwardly projecting slot for receiving a second portion of the supporting structure, when the bracket is in the final coupling position. Further, the end means can comprise a first projection adapted to be received through the first receiving aperture of the supporting structure, when the bracket is in the final coupling position. The supporting structure can comprise a second receiving aperture located below the  
15 first receiving aperture. The end means can comprise a second projection adapted to extend through the second receiving aperture when the bracket is in the final coupling position. The first portion of the supporting structure can be a vertically directed section of the supporting structure, which also forms a lower boundary of the first receiving aperture. The second portion of the supporting structure can be a vertically directed section of the supporting structure. The  
20 second portion can form a lower boundary of the second receiving aperture.

The bracket can include a terminating end opposite the end means. When the bracket is in the final coupling position, the bracket can remain substantially stationary without

any pivotal movement when upwardly directed forces are exerted on or adjacent to the terminating end.

In accordance with further aspects of the invention, a bracket is defined which is used with a stationary supporting rack having a lateral side. The lateral side includes an upper rack slot and a lower rack slot positioned directly below the upper rack slot. The bracket includes an end, and the end includes an upwardly projecting recess. An upper projection is adapted to be received through the upper rack slot, when the bracket is in a final coupling position relative to the rack. A first downwardly projecting slot is formed adjacent the upper projection, and is adapted to receive a first portion of the rack when the bracket is in the final coupling position relative to the rack. A second lower projection is positioned below the upper projection, and is adapted to be received through the lower rack slot when the bracket is in the final coupling position. A second downwardly projecting slot is formed adjacent the lower projection. The slot is adapted to receive a second portion of the rack when the bracket is in the final coupling position.

The first portion of the rack forms a lower edge of the upper rack slot. Correspondingly, the second portion of the rack forms a lower edge of the lower rack slot. Still further, each of the first and second downwardly projecting slots can be of a rectangular configuration. In addition, the first downwardly projecting slot can be substantially identical to the second downwardly projecting slot in size and shape.

Still further, the supporting rack can have a lateral side with a lateral rack slot, along with a top section with a top rack slot. The bracket can have an end, with the end having an upper projection adapted to be received through the lateral rack slot when the bracket is in a final coupling position relative to the rack. A first downwardly projecting slot can be formed

adjacent the upper projection and adapted to receive a first portion of the rack when the bracket is in the final coupling position relative to the rack. The upper projection can be further adapted to be partially received through the top rack slot when the bracket in the final coupling position.

In accordance with other aspects of the invention, the supporting structure can include a tie and belt rack. The bracket can include an upright formed in the end means. An arcuate intermediate portion can be integrally formed and projected downwardly from the upright. The downwardly projecting slot can be formed in an underneath surface of the arcuate portion. A U-shaped hook can be provided having an upwardly projecting opening, formed by a downwardly projecting side integrally formed with the arcuate portion.

Still further, the bracket can include an elongated portion terminating in distal end having lip means for assisting and maintaining the position of an element to be supported on an upper surface of the elongated portion. The end means can comprise a proximal end having an upper portion with an arcuate configuration. An upwardly projecting recess can be formed within the arcuate-shaped upper portion. An upper projection can be formed along the end of the upper arcuate-shaped portion, and extend substantially horizontally and not bend downwardly from the upper portion. A lip can be formed at the lower portion of the upper projection, with the lip projecting downwardly so as to form the downwardly projecting slot.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

The invention will now be described with reference to the drawings, in which:

FIG. 1 is a prior art perspective view of a horizontally disposed bracket well known in the art;

FIG. 2 is a partially side elevation view of the prior art bracket illustrated in FIG. 1, and illustrating releasable coupling with a horizontal rack shown in a cross section and a partially diagrammatic view;

FIG. 3 is a perspective view of a horizontally disposed universal lock-in bracket  
5 in accordance with the invention;

FIG. 4 is a view that is similar to the prior art view of FIG. 2, but showing the bracket in accordance with the invention of FIG. 3 in a releasable coupling with a horizontally disposed rack, with the rack shown in a cross section and a partially diagrammatic view;

FIG. 5 is a side elevation view of a horizontal rack which may be employed with  
10 the bracket shown in FIG. 3, and with the rack of FIG. 5 illustrated in partially diagrammatic fashion in FIG. 4;

FIG. 6 is partially a side elevation view of the bracket in accordance with the invention in a manually releasable coupling with the horizontal rack, and illustrating the manner in which the bracket may be coupled and de-coupled from the horizontal rack;

FIG. 7 is a side elevation view of a second embodiment of a rack which may be  
15 utilized with a bracket in accordance with the invention, with the rack being adapted for relatively small strength requirements;

FIG. 8 is a plan view of the horizontal rack illustrated in FIG. 7;

FIG. 9 is a cross sectional view of a bracket in accordance with the invention,  
20 which may be employed in a manually releasable manner with the rack shown in FIGS. 7 and 8;

FIG. 10 is a side elevation view of a tie and belt rack and shelf, illustrating the use of a bracket in accordance with the invention;

FIG. 11 is a further embodiment of a bracket in accordance with the invention, and capable of use for various supporting functions, including the support of shovels, hoses, lawn implements and the like;

FIG. 12 illustrates a further embodiment of a bracket in accordance with the invention, and adapted for use to hold a plurality of differing styles of handles; and

FIG. 13 is an illustration of a still further embodiment of a supporting element employing a bracket in accordance with the invention, and adapted for use in releasably supporting various types of household items, such as belts, keys and the like.

#### DETAILED DESCRIPTION OF THE INVENTION

The principles of the invention are disclosed, by way of example, in various bracket configurations as illustrated primarily in FIGS. 3 – 13. Brackets in accordance with the invention may be characterized as "hook-in" or "lock-in" bracket configurations with respect to support on various types of racks or ladders. With brackets in accordance with the invention, the end which is characterized as the "hook end" (as described in subsequent paragraphs herein) provides significant advantages over what may be characterized as the "hook over" prior art bracket arrangements. The two main advantages are: the lock-in configuration allows for increased security which may be of value in a number of applications; and configurations in accordance with the invention facilitate a relatively more desirable distribution of stresses in the bracket and support components. The changes in stress concentrations will result in lighter gauge materials providing the same functional strength in many applications. The use of lighter gauge materials will result in cost reductions for the producers of these applications. Still further, and what will be apparent from the description in subsequent paragraphs herein, the "hook-in" or "lock-in" design and structure of brackets in accordance with the invention

essentially prohibits the bracket from being taken out of its releasable coupling from the rack or ladder, unless the bracket is actually vertically "lifted" from the rack. Still further, depending upon the particular strength required for the bracket configuration in accordance with the invention, various numbers of pluralities of supports and lock-in brackets may be employed, again depending upon the requisite strength.

Turning to the drawings, and particularly FIGS. 3 and 4, FIG. 3 illustrates a perspective view of a bracket system, comprising a bracket 200 in accordance with the invention. As with prior art brackets, the bracket 200 may include an elongated portion 202 terminating in a distal end 204 having an upwardly projecting lip 206. The upwardly projecting lip 206 is adapted to assist in maintaining the position of an element to be supported on an upper surface 208 of the elongated portion 202. Of course, in a typical supporting arrangement, a plurality of brackets 200 would be employed.

In addition to the foregoing, the bracket 200, comprising one embodiment of a bracket in accordance with the invention, also includes a proximal end 210 as primarily illustrated in FIGS. 3 and 4. The proximal end 210 may be characterized as an "end means" as part of the bracket 200. Referring to these drawings, the proximal end 210 includes an upper portion 212 having an arcuate shape (as shown in FIGS. 3 and 4). The arcuate-shaped upper portion 212 is formed with an upwardly projecting recess 214. As illustrated, the upwardly projecting recess 214 is essentially of a relatively wide U-shaped form, and may be used to partially support the bracket 200 in a coupling arrangement with a rack as described in subsequent paragraphs herein.

Formed along the end of the upper arcuate-shaped portion 212, and located to the right of the upwardly projecting recess as illustrated in FIG. 4, is an upper projection 216, having

the shape shown in FIGS. 3 and 4. The projection 216 at the upper portion thereof extends substantially horizontally and then downwardly. At the lower portion of the projection 216 is a lip 218. The lip 218 projects downwardly so as to form a downwardly projecting slot 220. As further illustrated in FIGS. 3 and 4, the downwardly projecting slot 220 includes an upper surface 222. It is the positioning of the downwardly projecting slot 220 and the functions thereof, which provide a substantial basis for the novel concepts of the invention.

In addition to the upper projection 216 and the downwardly projecting slot 220 therein, the proximal end 210 also includes a second projection 224 formed directly below the first upper projection 216. The projection 224 has a configuration as primarily shown in FIG. 4, and forms somewhat of a rectangular shape with its lower portion forming a lip 226. The lip 226 has a shape substantially similar to the lip 218 formed at the lower portion of the upper projection 216. The lip 226 forms, with the main body of the proximal end 210, a second downwardly projecting slot 228. The second downwardly projecting slot 228 is of a size and configuration substantially conforming to the upper downwardly projecting slot 220.

Correspondingly, each of the downwardly projecting slots 220, 228 may have a substantially rectangular configuration. The second downwardly projecting slot 228 is formed with an upper surface 230. For purposes of general description, each of the upper downwardly projecting slots 220 may be characterized as a first downwardly projecting slot, while each of the slots 228 is characterized as a second downwardly projecting slot.

The bracket 200, in accordance with the invention and as described with respect to FIGS. 3 and 4 in the foregoing paragraphs, may be releasably coupled to the rack 130 which was previously described in substantial part with respect to use with the prior art bracket 100 illustrated in FIGS. 1 and 2. The rack 130 may be characterized as a "supporting structure" for

the bracket 200 and other bracket systems in accordance with the invention. The rack 130, as illustrated in FIG. 5, includes a row of upper rack slots 132, and a row of lower rack slots 134. For purposes of description, each of the upper rack slots 132 may be characterized, in accordance with the invention, as a "first receiving aperture." Correspondingly, each of the individual ones of the lower rack slots 134 may be characterized, again in accordance with the invention, as a "second receiving aperture." The rack 130 includes intermediate portions 136 located directly between corresponding ones of the upper rack slots 132 and lower rack slots 134. As also illustrated in FIG. 5, a series of individual intermediate slots 232 may also be formed in the rack 130. Such intermediate slots may be used with other embodiments of brackets in accordance with the invention, as described in subsequent paragraphs herein. Still further, if desired, the rack 130 may be employed in a horizontally disposed manner with other racks coupled serially in the same horizontal plane as the rack 130, through a coupling plate 234. The coupling plate 234 may be interconnected to the rack 130 through screws 236 or similar connecting means threaded or otherwise received through apertures 238 formed in the rack 230. In addition, screws or other connecting means may be received through the apertures 238 for purposes of interconnecting the rack 130 in a fixedly secured manner to a wall or similar vertical surface (not shown).

Reference will now be made to FIGS. 3, 4, 5 and 6 with respect to releasable interconnection and de-connection of the bracket 200 with the rack 130. A partial cross section and partially diagrammatic view of the rack 130 is illustrated in FIG. 4. For assembly of the bracket 200 with the rack 130, the bracket 200 may be positioned in a manner shown by the phantom diagram A of the bracket 200 as illustrated in FIG. 6. In this configuration, the bracket 200 is positioned in a pivoted configuration. With this configuration, the upper projection 216 of



the upper portion 212 is essentially inserted into one of the upper rack slots 132. The bracket 200 should be sufficiently pivoted so that the lip 218 of the upper projection 216 can pass through the upper slot 132. In this position, the bracket 200 can then be pivoted downwardly back to a horizontally disposed position. With the bracket 200 pivoted back to the its

5 horizontally disposed position, the upper projection 216 will have passed through the upper rack slot 132, and the second projection 224 will have passed through a corresponding one of the lower rack slots 134. This position is essentially shown in the phantom line configuration of the bracket 200 illustrated as phantom line configuration B in FIG. 6. Following such movement, downwardly projecting forces may be exerted on the bracket 200 so as to provide for a "lock-in"

10 of the bracket 200 with the rack 130. In this configuration, shown in solid line format in FIG. 6 and shown in an enlarged format in FIG. 4, the upwardly projecting recess 214 partially captures an upper portion 240 of the rack 130 located above the rack slot 132. Correspondingly, and of primary importance, the downwardly projecting slot 220 captures the intermediate portion 136 located between the rack slots 132 and 134. Each of the intermediate portions 136 associated

15 with the rack 130 may be characterized as a "first portion" of the rack 130, which is captured or "received" within a corresponding downwardly projecting slot 220. In addition, with the particular bracket 200 in accordance with the invention, the second downwardly projecting slot 228 formed by the lip 226 of the second projection 224 captures a lower portion 242 of the rack 130, located directly below the lower rack slot 134. For purposes of description, each of the

20 lower portions 242 of the rack 130 may be characterized as a "second portion" of the rack 130, which is received within a corresponding one of the second downwardly projecting slots 228. Further, as earlier described, the rack slots 132 may be characterized as first receiving apertures, while the rack slots 134 may be characterized as second receiving apertures. With this particular

configuration, the bracket 200 in accordance with the invention is releasably secured to the rack 130.

The bracket 200 in accordance with the invention provides several significant advantages over the prior art. First, it should be noted that the configuration primarily illustrated in FIG. 4 provides for a "hook-in" or "lock-in" coupling between the bracket 200 and the rack 130. This is opposed to the "hook-over" coupling of the bracket 100 in rack 130 previously described herein and illustrated in the prior art diagram of FIG. 2. With this "lock-in" configuration, the upper projection 216 may be characterized as a "hook end" 216. The hook end 216 forming the upper projection 216 is relatively stronger than standard brackets utilizing the "hook-over" configuration. In part, this additional strength is provided by the fact that stresses from a cantilevered load are distributed more evenly, thereby reducing the stress concentrations present in the supporting portion of brackets, such as bracket 100 illustrated in FIG. 1. That is, as earlier mentioned, cantilevered loads produce certain stresses in a manner such that the stress distribution can comprise highly localized stresses. That is, the stress concentration factor may be relatively high. However, with a bracket configuration such as the bracket 200, these stresses resulting from the load have relatively more even distribution. The stress concentration throughout the overall design, and of course corresponding stress concentration factors, are thereby reduced. Still further, with the lock-in design of brackets in accordance with the invention, such as the bracket 200, the bracket is substantially more "stable" than conventional brackets as coupled to racks. Again, this is essentially because of the "lock-in" configuration which is provided by, in this case, the downwardly projecting slot 220 and the second downwardly projecting slot 228 within the proximal end 210 of the bracket 200.

Advantages also exist with respect to disassembly or de-coupling of the bracket 200 from the rack 130, and the affirmative movements which are required for such de-coupling. Turning primarily to FIG. 6, and as earlier stated, the illustration of the bracket 200 in FIG. 6 in solid line format represents the bracket 200 in a "lock-in" configuration with the rack 130. With  
5 prior art brackets, inadvertent de-coupling of the bracket from an associated rack could happen relatively easily, in that many of the prior art brackets could be de-coupled from the racks merely by an upward pivoting force on the distal end of the prior art bracket. In contrast, with the bracket 200 in accordance with the invention, de-coupling first requires the exertion of upwardly directed forces on the bracket 200. That is, forces must primarily be vertically directed, rather  
10 than directed in an angular fashion which would occur with a pivoting force. This upward or lifting force is required so as to de-couple the captured intermediate portion 136 of the rack 130 from the downwardly projecting slot 220, and to de-couple the lower portion 242 from its capture within the second downwardly projecting slot 228. The location of the bracket 200 after exertion of the lifting forces is shown as an arrow, and also in the phantom line configuration B  
15 in FIG. 6. With respect to the various configurations of the bracket 200 illustrated in FIG. 6, the position illustrated by the phantom line configuration B may be characterized as a "first coupling position" of the bracket 200 relative to the rack 130. Correspondingly, the solid line configuration of the bracket 200 in FIG. 6 may be characterized as a "final coupling position" of the bracket 200 relative to the rack 130. After exerting the lifting forces, pivoting forces can  
20 then be applied to the distal end 204 of the bracket 200 so as to pivot the bracket 200 in a manner so that the upper projection 216 and second projection 224 of the bracket 200 are removed from the slots 132 and 134, respectively. For many configurations of brackets and rack arrangements, it is desirable to require this lifting force, so as to prevent inadvertent de-coupling of the brackets

from the racks. In accordance with the foregoing, the bracket 200 in accordance with the invention, relative to its position associated with the rack 130 may be characterized such that rotational or pivotal forces exerted on the bracket 200 about any of the area adjacent the downwardly projecting slots 220, 228 are prevented from moving the bracket 200 from the final coupling position to the first coupling position. That is, movement from the final coupling position to the first coupling position requires the bracket 200 to be first "lifted directly vertically upward" relative to the rack 130.

Still further, the first portion of the rack 130, which is characterized as the intermediate portion 136, can be characterized as a vertically directed section. This first portion or intermediate portion 136 can further be characterized as forming a lower boundary of the slot 132, which can also be characterized as the first receiving aperture. When in the final coupling position, this first portion or intermediate portion 136 is supported on an upper surface 222 of the downwardly projecting slot 220. Correspondingly, when in the final coupling position, the second portion 242 is supported on an upper surface 230 of the downwardly projecting slot 220. This second portion 242 is also characterized as a lower portion 242 of the rack 130.

The bracket 200, and its releasable coupling to rack 130 as described in foregoing paragraphs, relates to a first embodiment of a "lock-in" bracket configuration in accordance with the invention. Other embodiments of brackets in accordance with the invention may also be employed. In this regard, FIG. 9 illustrates a second embodiment of a bracket in accordance with the invention, identified as bracket 300. The bracket 300 is adapted to be utilized with various types of slotted racks and ladders, including the exemplary rack 302 illustrated in FIGS. 7 and 8. The rack 302 is of an elongated configuration and is primarily adapted to be horizontally disposed on a wall or other surface (not shown). The rack includes a lateral surface

304 having a series of spaced apart slots 306 extending therethrough, all within substantially the same horizontal plane. The rack 302 also includes a coupling plate 308 which may be utilized to extend similar brackets 302 along a horizontal plane in seriatim. The coupling plate 308 may be coupled to the rack 302 through the use of screws 310 (or similar connecting elements)

5 extending through one or more apertures 312.

In addition to the rack slots 306 in the lateral surface 304 of the rack 302, the rack 302 includes an upper surface 314 as primarily shown in FIG. 8. The upper surface 314 include a set of spaced apart upper rack slots or apertures 316 having the configuration illustrated in FIG. 8. The upper rack slots 316 are positioned on the upper surface 314 so that each one of the upper  
10 rack slots 316 is aligned within the same vertical plane as a corresponding one of the lateral rack slots 306.

As previously stated herein, the exemplary rack 302 can be adapted to releasably couple with the embodiment comprising the bracket 300 in accordance with the invention.

Turning again to FIG. 9, the bracket 300 is illustrated in solid line format and in two other  
15 positions in phantom line format. Referring to the solid line format configuration of the bracket 300 in FIG. 9, the bracket 300 includes an upright portion 318. The upright portion 318 extends downwardly to an arcuate intermediate portion 320. Formed on an underside surface 322 of the arcuate intermediate portion 320 is a downwardly projecting slot 324 having the shape and relative configuration as illustrated in FIG. 9. Extending laterally and downwardly from the  
20 arcuate intermediate portion 320 is a lower end portion 326.

The coupling and de-coupling in a manually releasable manner of the bracket 300 with the rack 302 will now be described with respect to FIGS. 7, 8 and 9. The bracket 300 can first be manually positioned relative to the rack 302 in a pivoted configuration as illustrated by

the phantom line configuration identified as configuration C. With this pivoted or tilted configuration, the bracket 300 can be positioned so as to insert the upright 318 of the bracket 300 through a lateral rack slot 306. When the upright 318 extends a sufficient distance through the lateral rack slot 306, the bracket 300 can be pivoted in a direction which will correspond to a counter-clockwise rotation in the view of FIG. 9. This rotation will cause the bracket 300 to move from the phantom line configuration C to the phantom line configuration D as illustrated in FIG. 9. In this particular phantom line configuration D, the upright 318 extends upwardly through a corresponding one of the upper rack slots 316. With the bracket 300 there positioned, downwardly directed forces may be exerted on the bracket 300 so that a portion 328 of the lateral surface 304 illustrated in FIG. 9 is captured within and extends upwardly within the downwardly projecting slot 324. The capture of the portion 328 within the downwardly projecting slot 324 provides the "lock-in" configuration of the bracket 300 with the rack 302 in accordance with the invention.

With this "lock-in" configuration, de-coupling of the bracket 300 from the rack 302 will first require the exertion of upwardly directed forces (shown by the arrow 330 in FIG. 9) against the bracket 300. These upwardly directed forces in the direction of arrow 330 will cause the bracket 300 to be de-coupled from the rack 302, in that the upper portion 328 of the lateral surface 304 is removed from the downwardly projecting slot 324. The upwardly directed forces along arrow 330 may continue until the bracket 300 is in the position illustrated by phantom line configuration D. Thereafter, the bracket 300 may be manually pivoted, in the direction illustrated by arrow 332 in FIG. 9, to the position shown by phantom line configuration C. When the bracket 300 is in the position illustrated by phantom line configuration C, the bracket 300 can be moved in a direction (to the left as viewed in FIG. 9) so as to remove the upright 318 and

arcuate intermediate portion 320 from the lateral rack slot 306. As with the previously described bracket 200 with rack 130, the bracket 300 with rack 302 also provides the advantageous "lock-in" features. In this particular instance, the bracket 300 only employs the capture of the rack 302 within one downwardly projecting slot, namely downwardly projecting slot 324. However, as  
5 illustrated with bracket 200, a bracket in accordance with the invention employing the lock-in features may be utilized with any number of downwardly projecting slots, dependent upon the strength required for the bracket. Of course, variations in the lock-in features provided by the slots will require variations in the racks which would be employed with the brackets.

With respect to the foregoing description of the bracket 300 used in a bracket  
10 system in accordance with the invention, the bracket 300 may be characterized as having an "end means" which comprises the upright portion 318 and the arcuate intermediate portion 320. As earlier stated, the downwardly projecting slot 324 can be formed on an underside surface 322 of the arcuate intermediate portion 320. Still further, the rack 302 may be characterized as having the lateral surface 304, with spaced apart slots 306. The spaced apart slots 306 may be  
15 characterized as first receiving apertures 306. Correspondingly, and as earlier described, the rack 302 includes upper rack apertures 316 within an upper surface 314. Still further, with this configuration, the solid line representation of the bracket 300 in FIG. 9 may be characterized as a "final coupling position" of the bracket 300 relative to the bracket 302. When the bracket 300 is in the final coupling position relative to the rack 302, an end of the upright portion 318 at least  
20 partially extends upwardly through a corresponding one of the upper rack apertures 316.

In summary with respect to certain of the embodiments previously described herein, and first with respect to the embodiment illustrated in FIGS. 3 and 4, the bracket 200 includes a downwardly projecting slot 220 for receiving a first portion 136 of the rack 130. A

second downwardly projecting slot 228 is provided for receiving a second portion 242 of the rack or supporting structure 130 when the bracket 200 is in the final coupling position relative to the rack 130. Still further, the bracket 200 includes a first projection 216 which is adapted to be received through a first receiving aperture 132 when the bracket 200 is in the final coupling position. A second projection 224 is adapted to extend through the second receiving aperture 134, also when the bracket 200 is in the final coupling position. The second receiving aperture 134 is located directly below a corresponding one of the first receiving apertures 132. Still further, the first portion 136 of the rack 130 is a vertically directed section of the rack 130, and forms a lower boundary of the first receiving aperture 132. Correspondingly, the second portion 242 of the rack or supporting structure 130 is also a vertically directed section of the rack or supporting structure 130, and forms a lower boundary of the second receiving aperture 134.

Still further, the bracket 200 was described as having a distal end 204. The distal end 204 may be characterized as a "terminating end," which is opposite to the "end means" or proximal end 210. In accordance with the foregoing description, when the bracket 200 is in the final coupling position, it will remain substantially stationary without any pivotal movement, when upwardly directed forces are exerted on or adjacent to the terminating end 204. That is, as previously described, the forces must cause the bracket to be vertically lifted directly upward, in order to remove the bracket 200 from the rack 202. Still further, and with respect primarily to FIGS. 4 and 5, the rack 130 may be characterized as having a lateral side, with upper rack slots 132 and lower rack slots 134. The lower rack slots 134 are positioned directly below the upper rack slots 132. Also with respect to FIGS. 4 and 5, the bracket 200 includes, as previously described, an upwardly projecting recess 214. Also as previously described, the upper projection 216 is received through the upper rack slot 132 when the bracket 200 is in a final coupling



position relative to the rack 130. Further, the first portion 136 of the rack 130 forms a lower edge of the upper rack slot 132, while a second portion 242 of the rack 130 forms a lower edge of the lower rack slot 134.

In addition to the embodiments of brackets in accordance with the invention,  
5 described and illustrated herein as brackets 200 and 300, various other types of bracket configurations in accordance with the invention may be utilized, each employing the "lock-in" features of the invention. For example, FIG. 10 illustrates a tie and belt rack and shelf 360. The tie and belt rack and shelf 360 is illustrated in a side elevation view in FIG. 10, and includes a conventional shelf 362 having a bracket 364 mounted therebelow. The bracket 364 has a main  
10 body 366 having a substantially triangular configuration. At a rear portion of the tie and belt rack and shelf 360 is a bracket coupler 368. As illustrated in FIG. 10, the bracket coupler 368 includes an upright 370. The upright 370 extends downwardly to an arcuate portion 372. The underside surface of the arcuate portion 372 is interrupted by and forms a downwardly projecting slot 374. The tie and belt rack and shelf 360 may be employed with a rack, such as the rack 302  
15 previously described herein with respect to FIGS. 7, 8 and 9. That is, the downwardly projecting slot 374 within the coupler 368 would be utilized to capture the upper portion 328 of the lateral rack surface 304 of rack 302.

Another embodiment of a "lock-in" bracket in accordance with the invention is illustrated in FIG. 11 as bracket 380. With reference to FIG. 11, the bracket 380 includes an  
20 elongated portion 382, having a distal end terminating in an angularly and upwardly projecting lip 384. The bracket 380 also includes a proximal end 386 having an upright 388 integrally formed with an arcuate lower portion 390. Formed within an underside surface of the arcuate portion 390 is a downwardly projecting slot 392. As with the bracket 360 illustrated in FIG. 10,

the bracket 380 illustrated in FIG. 11 may be utilized in a manner whereby the downwardly projecting slot 392 captures an upper portion 328 of a lateral rack surface 304 of the rack 302. Coupling and de-coupling of the brackets 360 and 380 with the rack 302 will occur in the same manner as that described with respect to the bracket 300 with rack 302 as illustrated in FIGS. 7, 8 and 9. Also, it should be mentioned that the bracket 380, and other brackets in accordance with the invention, could be modified somewhat in design so that the upright 388 does not extend into a slot in an upper surface of a horizontal rack but, instead, is relatively shorter in length so that the upright 370 essentially abuts a closed upper surface of a horizontal rack. The bracket 380 illustrated in FIG. 11 may be characterized as a universal bracket, utilized with conventional pegboard designs or similar types of racks. The bracket 380 may be utilized for various supporting functions. For example, with its elongated length and the elongated portion 382, the bracket 380 may be utilized to support multiple shovels, relatively large sized lawn implements and the like.

FIG. 12 illustrates a further bracket 400. The bracket 400 is of a different embodiment than the brackets previously described herein, but still functions in accordance with the invention. More specifically, the bracket 400 is adapted to support various styles of handles of household and related items. The bracket 400 includes an upright 402. Integrally formed with and projecting downwardly from the upright 402 is an arcuate portion 404. The underside surface of the arcuate section 404 is interrupted by and forms a downwardly projecting slot 406. The downwardly projecting slot 406 acts to capture a corresponding rack (not shown) in the same manner as the downwardly projecting slots 392 and 374 of racks 380 and 360, respectively. The bracket 400 also includes a support section 408. If desired, the bracket 400 can also include

a snap element 410 formed at a 90<sup>0</sup> angle for purposes of elements which are supported in a snap-on fashion.

A still further embodiment of a bracket in accordance with the invention is illustrated in FIG. 13 as bracket 420. Bracket 420 again can be characterized as a somewhat of a universal bracket, in that it may be utilized for purposes of supporting belts, keys, electrical cords or any other items which may be characterized as having a "opening." Turning to FIG. 13, the bracket 420 includes an upright 422. Integrally formed with and projecting downwardly therefrom is an arcuate intermediate portion 424. Formed in an underneath surface of the arcuate portion 424 is a downwardly projecting slot 426. The downwardly projecting slot 426 is of the same configuration and provides the same functions as the downwardly projecting slots 406, 392 and 374 associated with brackets 400, 380 and 360, respectively. Accordingly, the bracket 420 could be utilized with a rack such as the rack 302 previously described herein with respect to FIGS. 7, 8 and 9.

For purposes of supporting various items, the bracket 420 includes a U-shaped hook 428 having an upwardly projecting opening. The hook 428 is formed by a downwardly projecting side 430 integrally formed with the arcuate portion 424. Extending horizontally from the lower end of the downwardly projecting side 430 is an intermediate portion 432. The intermediate portion 432, at its other end, is integrally formed with an upwardly projecting leg 434. The leg 434, portion 432 and side 430 form the U-shaped hook 428.

Various brackets have been described in the foregoing paragraphs, which are structured and function in accordance with the invention. In particular, the use of the lock-in feature prohibits the bracket in accordance with the invention from being inadvertently decoupled from its corresponding rack, without an individual exerting upwardly projected forces so

as to essentially "lift" the bracket so as to remove one or more portions of the corresponding rack from one or more downwardly projecting slots formed in the bracket in accordance with the invention. It should be emphasized that various sizes and configurations of "lock-in" features may be utilized in accordance with the invention, depending upon strength required and other  
5 requisite design characteristics. Correspondingly, various types of racks may also be employed with brackets in accordance with the invention. For example, the horizontal rack 130 previously described herein can be characterized as a "medium strength" rack. Correspondingly, the rack described herein as rack 302, employing only single rows of slots, is often characterized as a "small strength" horizontal rack. Of course, various other sizes and shapes of racks may be  
10 utilized in accordance with the invention. For example, horizontal racks which may be characterized as "extra strength" racks often have the same shape and structural configuration as the medium strength horizontal rack 130 described herein, but manufactured with "thicker" materials. Still further, brackets in accordance with the invention may readily be utilized with vertically disposed racks or "ladders." As earlier mentioned, such ladder arrangements are often  
15 employed with residential bookshelving systems, refrigerators and other appliances. In summary, brackets in accordance with the invention which employ the lock-in features described and illustrated herein provide significant advantages over known bracket and rack systems, with respect to strength, structural integrity, support and other functionalities.

Still further, bracket configurations in accordance with the invention provide  
20 advantages with respect to undesired stress concentrations. Stress concentrations are conditions in which stress distributions comprise highly localized stresses. Such concentrations often exist in the vicinity of notches, holes and the like. In fact, where there is geometrical discontinuity in various elements, maximum stress is often several times greater than in designs having no such

discontinuities. With brackets such as bracket 200 described herein and manufactured in accordance with the invention, stresses from cantilevered loads exerted on the bracket are distributed relatively more evenly. With this more even distribution, stress concentrations are reduced in the overall design of the bracket and rack configuration. The inventors believe that this reduction in stress concentration is a principal aspect of the invention.

The reduction and stress concentration is of particular significance with respect not only to reducing the probability of fractures and other component failures, but also provides an advantage in that less costly materials may be employed in the manufacture of the bracket and rack components. A particular example of the advantages resulting from the reduction of stress concentration relates to the refrigeration industry. Refrigerator appliances often use vertically disposed ladders for purposes of mounting their shelving brackets. Shelving brackets for refrigerator appliances are often referred to as "side arms." Such brackets or side arms may have a configuration corresponding to the configuration of brackets 200 as previously described herein. By providing brackets 200 in accordance with the invention, stress concentration may be reduced. This reduction in stress concentration permits the use of lighter gauge materials for manufacture not only of the side arms or brackets, but also for the ladders supporting the side arms or brackets. Of course, although this is a particular advantage in the refrigeration industry, it is apparent that many other commercial, residential and industrial applications exist which could utilize bracket and rack configurations in accordance with the invention, and benefit from the capability of utilizing lighter gauge materials.

It will be apparent to those skilled in the pertinent arts that still other embodiments of brackets in accordance with the invention may be designed. That is, the principles of a bracket in accordance with the invention are not limited to the specific

embodiments described herein. Accordingly, it will be apparent to those skilled in the art that modifications and other variations of the above-described illustrative embodiments of the invention may be effected without departing from the spirit and scope of the novel concepts of the invention.